COLOR ME A WATERSHED

Objectives:

Using this Project WET activity, students will look at land use over the past hundred years as it relates to water use, pollution, contamination, and watersheds. They will describe how vegetation is an essential part of the natural system.

Materials:

- Copies of *Maps A,B, and C*
- Colored pencils
- Calculator
- Copies of the chart *Area of Land Coverage*
- Copies of the chart *Volume of Rain and Volume of Runoff*
- *Historical Landsat Data Comparisons* booklet

Background:

Resource managers and policy makers use maps to monitor land use changes that could contribute to increased amounts of runoff flowing into a river or streams. Land use changes can have significant impact on water resources of a region. Streams, lakes, and other bodies of water collect water drained from the surrounding land area, called a watershed or drainage basin. After periods of precipitation, surface water is captured by the soil and vegetation, stored in ground water and in plants and slowly released into the streams, lakes, or rivers. Changes in land use can alter the way water is released into these bodies of water. Resource managers are developing and using Geographic Information Systems (GIS) to generate land use maps. These maps can be compared with historic information to examine changes that have occurred in the watershed. By using this information land managers can carefully assess land use changes and set development policy accordingly. Explore the *Historical Landsat Data* booklet to see example of changes that have been documented in areas with information from satellites.

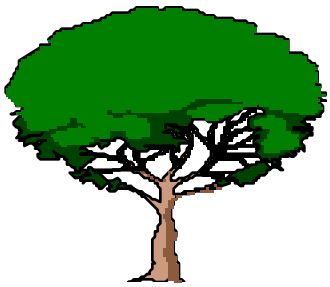
Procedure:

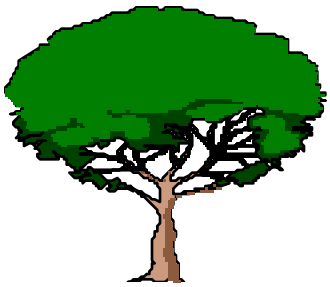
1. Discuss what your local area looked like one hundred years ago. List some of the changes that have occurred. Try to decide if these relate to water use, pollution, etc. in your area.
2. Hand out maps for the three different times (100 years ago, 50 years ago, present) and have students color the coded areas making sure the same colors are used for each sheet. Compare the sizes of the various areas over time.
3. Discuss one or more of the following: What has happened to the amount of forested land and the amount of settled land? Does this have an effect on the surrounding area? On wildlife? On the water supply? Would you have handled development differently? What do you think will happen in the next 50 years?
4. Determine the land area of each map. Each unit in the grid represents 1 square kilometer; there are 360 square kilometers on each map.
5. Determine how much land area is covered by each land type. (Example: the stream will always be 30.8%) Chart these answers in the *Area of Land Coverage* chart.

6. Tell students that 5cm (0.05m) of rain fell evenly on each part of the watershed. Determine the amount that fell on the total land area. (18,000,000 cubic meters of rain fell on the watershed.)
7. Using the chart, ask students to estimate the amount of water that drained into the stream for each time period. Discuss the changes in land coverage and ask students if they think the amount of runoff would increase or decrease with time.
8. After the students do their calculations, let them know Map A, 2,767,500 cubic meters was runoff. For Map B, 3,102,500 cubic meters was runoff. For Map C, 4,797,500 cubic meters was runoff.

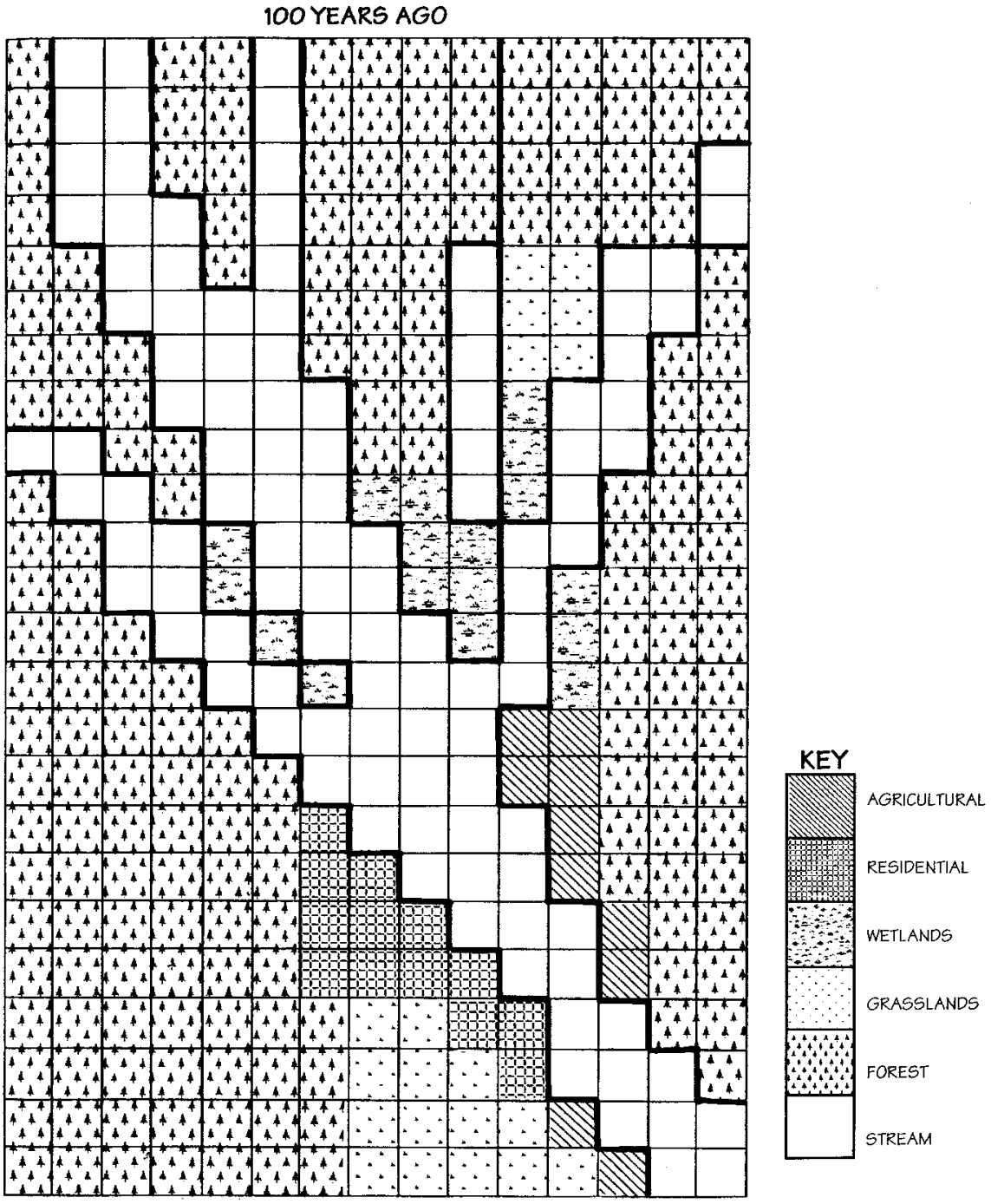
Discussion:

Have the students summarize how changes in the land affect the quantity and quality of runoff in a watershed. Discuss land use practices in the community and how they may affect water discharge in the watershed. Discuss areas that contribute to or reduce storm runoff. For example, parking lots, paved roads, and sidewalks promote runoff; parks, wetlands, and forests capture water. Which map represents the watershed that is able to capture and store the most water? What problems could arise if water runs quickly over surface material, rather than moving slowly or soaking in? How might the water quality of the stream be affected by changes in the watershed? What if there was a cave below the surface? Would the surface changes have any effect? How can local land practices be altered to improve the situation? Will this have an effect on wildlife as well as human activity? Compare your discoveries with the photographs in the *Historical Landsat* booklet.

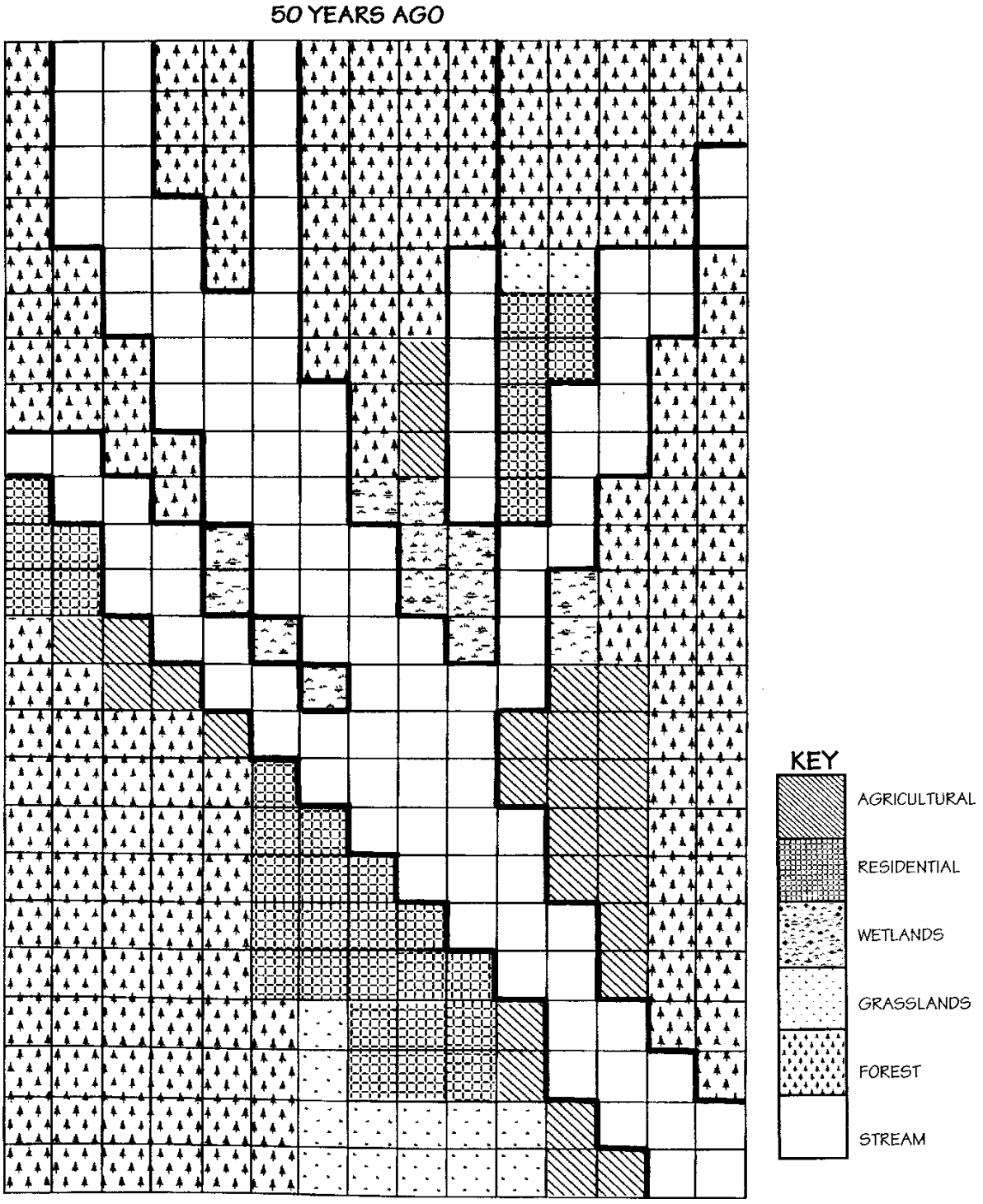




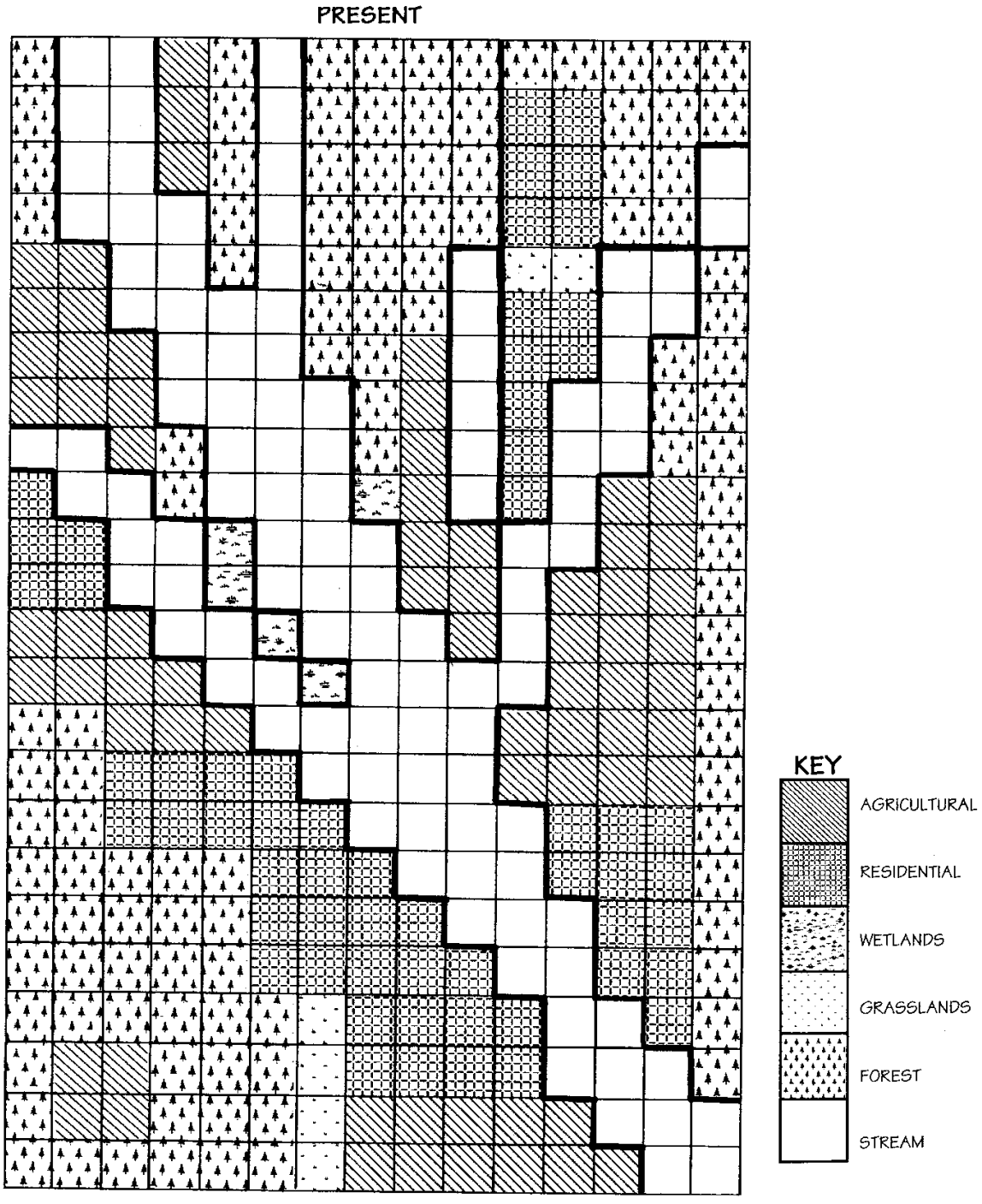
Map A



Map B


50 YEARS AGO
KEY
AGRICULTURAL
RESIDENTIAL
WETLANDS
GRASSLANDS
FOREST
STREAM

Map C


PRESENT
KEY
AGRICULTURAL
RESIDENTIAL
WETLANDS
GRASSLANDS
FOREST
STREAM

Name: _____ Date: _____

Chart for Option 2 AREA OF LAND COVERAGE

	MAP A 100 yrs. ago		MAP B 50 yrs. ago		MAP C Present	
Land coverage	km^2	%	km^2	%	km^2	%
Forest						
Grassland						
Wetland						
Residential						
Agriculture						
Stream						

Chart for Option 3 VOLUME OF RAIN AND VOLUME OF RUNOFF

	MAP A 100 years ago		MAP B 50 years ago		MAP C Present	
Land coverage and % runoff	**volume m^3**	**runoff m^3**	**volume m^3**	**runoff m^3**	**volume m^3**	**runoff m^3**
Forest 20% runoff						
Grassland 10% runoff						
Wetland 5% runoff						
Residential 90% runoff						
Agriculture 30% runoff						
Total runoff						
Total runoff plus stream discharge (5,550,000 m^3)						

Answer Key:

Volume of Rain and Volume of Runoff

Land coverage and % runoff	**Volume m^3**	**Runoff m^3**	**Volume m^3**	**Runoff m^3**	**Volume m^3**	**Runoff m^3**
Forest 20% runoff	(9.45×10^6) 9,450,000	(1.89×10^6) 1,890,000	(5.55×10^6) 5,550,000	(1.11×10^6) 1,110,000	(5.55×10^6) 5,550,000	(1.11×10^6) 1,110,000
Grasslands 10% runoff	(1.0×10^6)	(1.0×10^5) 100,000	(7.0×10^5) 700,000	(7.0×10^4) 70,000	(3.0×10^5) 300,000	(3.0×10^4) 30,000
Wetland 5% runoff	(8.5×10^5) 850,000	(4.25×10^5) 42,500	(6.5×10^5) 650,000	(3.25×10^4) 32,500	(2.5×10^5) 250,000	(1.25×10^4) 12,500
Residential 90% runoff	(6.5×10^5) 650,000	(5.85×10^5) 585,000	(1.65×10^6) 1,650,000	(1.485×10^6) 1,485,000	(2.9×10^6) 2,900,000	(2.61×10^6) 2,610,000
Agriculture 30% runoff	(5.0×10^5) 500,000	(1.5×10^5) 150,000	(1.35×10^6) 1,350,000	(4.05×10^5) 405,000	(3.45×10^6) 3,450,000	(1.035×10^6) 1,035,000
Total Runoff		2,767,500		3,102,500		4,797,500
Total runoff Plus stream discharge ($5,550,000\ m^3$)		(8.32×10^6) 8,317,500		(8.652×10^6) 8,652,500		(1.0347×10^7) 10,347,500